Current story endings. Are there more?

Sequential subsampling of a shared landscape in evolution and development

Fundamental limitation: all cells have the same genome so gene expression (landscape) needs to be partitioned to produce different phenotypes

Cell differentiation: subsampling of shared landscape

Just like in evolution, pathways “dissolve” behind the front
The central question of ecology and evolution

Is evolution of these mechanisms – the cause of diversification?

OR

Is diversification – the cause of evolution of these mechanisms?

Direct insight into the mechanisms

Retention of pluripotency until terminal stages by highjacking “pluripotency” factors and refusal to functionally integrate with other tissues

13 14 15 16 17 18
This is what you looked like when your germ cells (future eggs and sperm) segregated from the rest of your body's cells to never see them again.

Stage of germ cell segregation in humans

Gametogenesis - the process by which the sperm and the egg are formed

- Germ cells – provide the material continuity of life.
  - Mitotic ancestors of your germ cells once resided in the gonads of reptiles, fish, etc.
- In most animals – early developmental separation of germ and somatic cells
- In most animals – the germ cells do not arise from the gonad itself
  - Their precursors – the primordial germ cells, arise elsewhere and migrate into developing gonads

"Weismann's doctrine"

- Early and irreversible segregation of germ line from somatic cells
- Somatic cell lineages exist only for the length of the organism's life
- Somatic cells are developmentally different from "immortal" germ line which passes genetic information across generations
- Somatic cell cannot be converted into germ line, thus heritable information cannot pass from organism to its germ cells

Thus, the doctrine says that "inheritance of somatically acquired characters is impossible."
"Early" germ-line determination

14 phyla in animals + 1 in protists

Irreversible early segregation, often under maternal control; germ line cells tend to have slow division

"Late" germ-line determination

Chordata, hemichordata, arthropods, Platychelminths, echinoderms, mollusks

Germ-line distinct, but differentiates after formation of some somatic tissues; often induced by other tissues

Somaically derived germ cells

All plants, all fungi, all multicellular Protists (exc Volvox).

No clear distinction between germ and somatic cells; cells are multipotent

Applicability of the doctrine varies across animal groups...

<table>
<thead>
<tr>
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1) Actually program pluripotency
2) Resist formation of memory
3) Refuse to remember (not methylated)
4) Agnostic to memory
5) Maintain unorganized chromatin structure
6) Induce certain pattern of gene expression
7) Strongly competing fate-specific effects

Diversity of way of reprogramming informs us of diversity of ways to create control configurations.
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Why wait for cell programming for other function only to erase this programming later?

Developmental time